Review Article

Cysts About the Knee: Evaluation and Management

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Abstract

Popliteal (Baker) cysts, meniscal cysts, proximal tibiofibular joint cysts, and cruciate ligament ganglion cysts are cystic masses commonly found about the knee. Popliteal cysts form when a bursa swells with synovial fluid, with or without a clear inciting etiology. Presentation ranges from asymptomatic to painful, limited knee motion. Management varies based on symptomatology and etiology. Meniscal cysts form within or adjacent to the menisci. These collections of synovial fluid are thought to develop from translocation of synovial cells or extravasation of synovial fluid into the meniscus through a tear. Joint-line pain and swelling are common symptoms. Management entails partial meniscectomy with cyst decompression or excision. Proximal tibiofibular joint cysts are rare, and their etiology remains unclear. Pain and swelling secondary to local tissue invasion is common, and management consists of surgical excision. Cruciate ligament ganglion cysts have no clear etiology but are associated with mucoid degeneration of the anterior and posterior cruciate ligaments, knee trauma, and synovial translocation into these ligaments. Knee pain and limited range of motion, especially with exercise, are common presenting symptoms. In symptomatic cases, arthroscopic excision is commonly performed.

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None of the following authors or any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article: Dr. Stein, Dr. Cantlon, Dr. MacKay, and Mr. Hoelscher.

J Am Acad Orthop Surg 2013;21: 469-479

http://dx.doi.org/10.5435/JAAOS-21-08-469

The knee is one of the most commonly evaluated joints among various orthopaedic subspecialties. Cystic masses are frequently encountered during the course of physical examination or advanced imaging. It is important for clinicians to develop an appropriate differential diagnosis to guide further evaluation and management because these fluid collections range from benign and minimally symptomatic to aggressive and problematic.

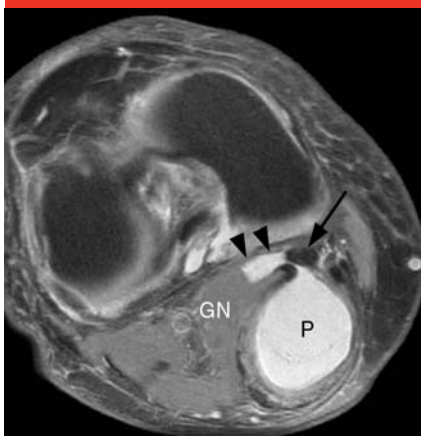
Basic characteristics such as cyst location, size, and relationship to anatomic structures may aid the clinician in developing an appropriate treatment plan.

Popliteal Cysts

Background

The popliteal fossa is home to six bursae, which are synovial-lined structures that prevent friction between tendons, muscles, and bones.[1,2] A bursa can become enlarged with fluid, leading to the formation of a cyst. The gastrocnemius-semimembranosus bursa, which is located beneath the medial head of the gastrocnemius muscle and the semimembranosus tendon, is most commonly involved in the formation of a popliteal (Baker) cyst[1,2] (Figure 1). Although the exact mechanism of

Figure 1



Axial proton density–weighted magnetic resonance image with fat suppression showing a large popliteal cyst (P) extending posteriorly between the medial gastrocnemius muscle (GN) and the semimembranosus tendon (arrow). Note the communication between the popliteal cyst and the subgastrocnemius bursa (arrowheads). (Reproduced with permission from Marra MD, Crema MD, Chung M, et al: MRI features of cystic lesions around the knee. *Knee* 2008;15[6]:423-438.)

cyst formation is unclear, several theories have been postulated.[2,3] One theory is that increased intra-articular pressure may cause a herniation of the joint capsule or force fluid to leak into a bursa that communicates with the joint. Another theory is that internal derangements alter the mechanics of the knee joint, pushing synovial fluid into communicating bursae.

In the contemporary literature, popliteal cysts are classified into two categories: primary and secondary. Primary cysts are idiopathic and often do not have a discernable communication with the joint. Secondary cysts are associated with knee joint pathology and may or may not have a discernable communication with the joint.[1,4]

Primary cysts are more common in children than adults. De Maeseneer et al[3] reviewed magnetic resonance images of the knee in 393 pediatric patients who were seen for knee pain and found that 25 patients (6.3%) had popliteal cysts. In these patients, average age was 8.2 years, with a male-to-female ratio of 3:2. No cysts demonstrated communication with the joint space, and no anterior cruciate ligament (ACL) or meniscal tears were found in patients with a popliteal cyst. However, four patients had an effusion, two had osteochondritis dissecans, one had juvenile rheumatoid arthritis, and one had an intra-articular infection. Gristina and Wilson[5] reviewed data from 84 patients with popliteal cysts who were treated surgically, 20 of whom were children younger than age 12 years. The authors noted a peak incidence at approximately age 5 to 6 years, with a male-to-female ratio of 13:7. No children displayed any joint pathology. However, 11 of 20 patients (55%) displayed communication between the bursa and the joint space. The authors suggested that pediatric popliteal cysts are likely related to trauma or some other irritation to an otherwise normal bursa, rather than from underlying intra-articular pathology.

Secondary popliteal cysts are more common in adults than children; however, estimates on their prevalence vary widely based on multiple variables, including imaging modality used for evaluation, patient age, and underlying joint pathology. Miller et al[6] reviewed 400 magnetic resonance images of the knee in patients (average age, 53 years) who were referred to orthopaedists for knee pain. The prevalence of popliteal cysts was 19%, with a male-to-female ratio of 29:48. The cysts were typically centered at the level of or just superior to the knee joint and were largest in the superior-inferior axis, with an average length of 3.5 cm. Sixty-six cysts were associated with internal derangement, 59 with effusion, and 53 with degenerative joint disease. In a study of 187 patients (average age, 43.4 years) with various diagnoses (none with a preoperative report of popliteal cyst or palpable mass) treated with arthroscopic knee procedures, Johnson et al[7] reported that the prevalence of popliteal cysts was 37%, with a male-to-female ratio of 49:24. The authors reported that older age was associated with the development of popliteal cysts. The prevalence of these cysts was 24% in patients aged 10 to 19 years compared with 60% in patients aged 70 to 79 years.

Clinical Presentation

In children, popliteal cysts are usually not incidental findings. Typically, pediatric patients are referred to an orthopaedist for a palpable mass in the posterior fossa, knee pain, or restricted range of motion (ROM). In general, these patients have no reported history of major trauma or preexisting knee pathology.[3-5,8] In adults, however, most popliteal cysts are discovered incidentally after routine imaging for various knee pathologies (Figure 2). Thus, the clinical presentation varies based on the associated condition from which the patient suffers. Adults with symptomatic popliteal cysts have a presentation similar to that of children: a palpable mass, pain, limited ROM and, in the case of cyst rupture, swollen calves. Popliteal cysts have also been shown to change in size and fluid pressure with movement of the knee joint. In extension, intra-articular pressure increases and the caliber of the communication with the joint space decreases, leading to increased intracyst pressures and a subsequent increase in the size of the cyst.[2] This has been associated with increased pain and motion restriction as well

Figure 2

AP radiograph of the knee showing several mineralized loose bodies (between the arrows) within a popliteal cyst. (Reproduced with permission from Beaman FD, Peterson JJ: MR imaging of cysts, ganglia, and bursae about the knee. *Rad Clin North Am* 2007;45[6]:969-982,vi.)

as compression of local structures, including the popliteal artery. In flexion, larger-caliber communication with the joint space decreases cyst pressure and size, allowing for partial relief of any symptoms.[2] This is important to consider because compression of local vascular structures and ensuing edema can cause symptoms such as claudication and pain that may confuse the clinical picture.[2,3,6]

Differential Diagnosis

In patients with leg swelling or vascular symptoms, deep vein thrombosis (DVT) must be ruled out. The patient with a popliteal cyst will have lower leg swelling preceded by knee and/or calf swelling, which is not typical in patients with a DVT. In a study of 988 venograms of the lower leg obtained to rule out DVT in patients with calf edema, Chaudhuri and Salari[9] noted that 23 patients had negative phlebograms, but the popliteal veins were deviated laterally, and 22 of these patients had popliteal cysts. Eighteen of these cysts had ruptured. This is important to note because anticoagulation in patients with popliteal cysts without DVT can lead to cyst hemorrhage.[2,9]

Other vascular pathologies must be excluded, as well. In patients with symptoms of claudication, peripheral arterial disease should be ruled out. Popliteal artery aneurysms can be evaluated with arteriography, ultrasound, or CT, with arteriography and ultrasound able to show blockage of the artery, and CT able to show a mass continuous with the vessel as well as possible rim calcification.[8,10] The extremity should also be evaluated for the presence of hematomas, popliteal vein varices, and tumors. Anatomic variants can mimic popliteal cysts; therefore, it is important to be able to distinguish between the two. Popliteal cysts are characterized by their homogeneous fluid filling, smooth synovium, and lack of associated knee joint pathology.[4]

Evaluation

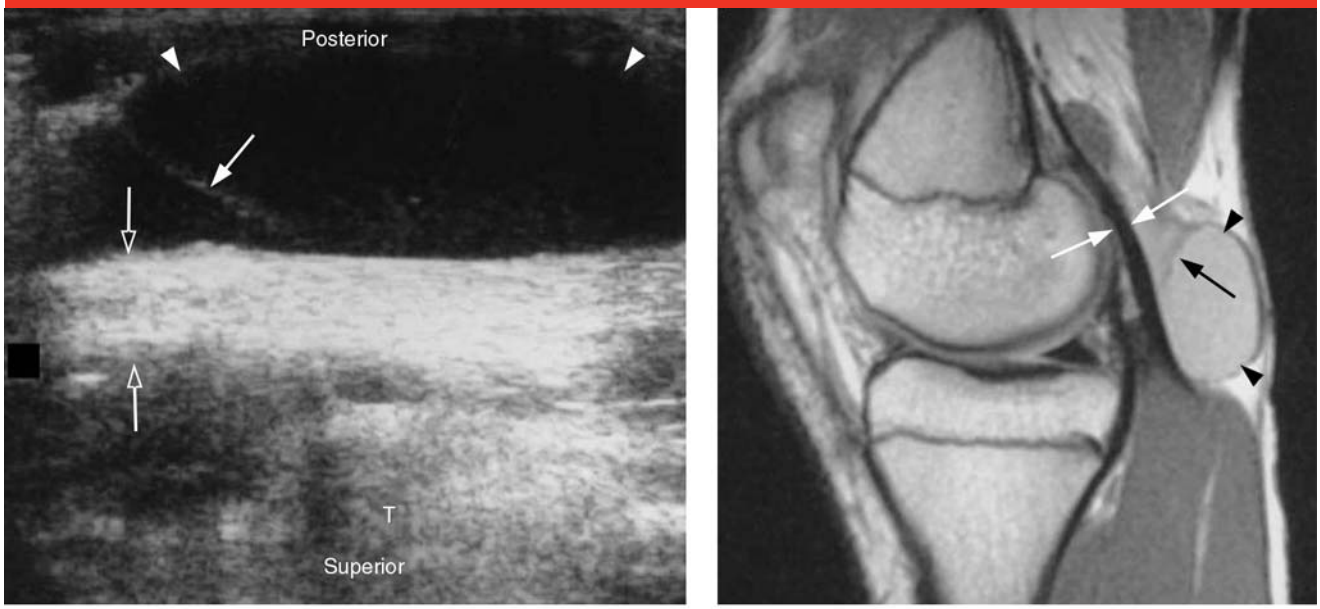
The physical examination should be performed with the patient supine, beginning with the knee in full extension. With the clinician's thumbs positioned anteriorly on the knee, palpation for posterior masses will typically reveal a medial mass, although popliteal cysts can also be located laterally. This examination should then be repeated in various degrees of flexion to observe any change in the size or tension of the mass (Foucher sign), which is indicative of a popliteal cyst.[2]

Imaging of popliteal cysts can be accomplished via several modalities, including arthrography, ultrasound, and MRI. Arthrography involves intra-articular injection of contrast with or without air followed by radiography. This modality is limited by its invasiveness, dependence on a communication with the joint space, inability to identify intra-articular pathology and nearby structures, and susceptibility to false positives.[1,2]

Ultrasound is typically preferred over arthrography for quick evaluation because of its low cost and noninvasive nature (Figure 3). In a study of 100 knees referred for suspected internal derangement, Hermann et al[11] compared the use of ultrasound to arthrography for diagnosis of popliteal cysts. In 73 cases, the two techniques were in agreement (58 with no cyst, 15 with a cyst). The remaining 27 were all positive on arthrography but negative on ultrasound. The authors argued that arthrography inflates the potential space of the gastrocnemius-semimembranous bursa, leading to a high rate of false positives. In a study of 36 patients who had a knee evaluated by both ultrasound and MRI, Ward et al[12] reported that MRI revealed 21 popliteal cysts, 1 meniscal cyst, 1 liposarcoma, and 13 knees without pathology. Twenty-three posterior knee masses were identified using ultrasound, but all were diagnosed as popliteal cysts. All 13 knees without pathology were correctly reported by ultrasound. Limitations of ultrasound include inconsistency in identifying small cysts (<5 mm) and inability to diagnose intra-articular pathology.

CT is another option for diagnosis of popliteal cysts, especially for cysts with no connections to the joint or those in unusual locations; it also can be used to evaluate for possible tumors or aneurysms.[2] In a study of eight patients referred for evaluation of an atypical soft-tissue mass about the knee joint, Schwimmer et al[13] reported that CT correctly identified all eight masses as synovial cysts.

Figure 3



A, Sagittal sonogram of the posterior view of the knee demonstrating a popliteal (Baker) cyst (arrowheads) in a 15-year-old boy. Note the septation (solid arrow). Open arrows = medial gastrocnemius tendon, T = tibia. **B,** Sagittal proton density–weighted magnetic resonance image demonstrating a popliteal (Baker) cyst (arrowheads). Note the septation (black arrow). White arrows = medial gastrocnemius tendon. (Reproduced with permission from Ward EE, Jacobson JA, Fessell DP, Hayes CW, van Holsbeeck M: Sonographic detection of Baker's cysts: Comparison with MR imaging. *AJR Am J Roentgenol* 2001;176[2]:373-380.)

However, other authors have suggested that diagnosis with CT can be adversely affected by cyst contents, rupture, or herniation of the synovium.[10] Although MRI is limited by expense, availability, and the ability of patients to tolerate the procedure, it remains the standard of care because it provides the best evaluation of the cyst and surrounding anatomy, defines the relationship of the cyst to local structures, and can be used to consistently evaluate intra-articular lesions.[1,4,8]

Management

Management of popliteal cysts depends on the underlying mechanism of cyst formation. In asymptomatic children, observation is typically preferred because many popliteal cysts disappear naturally. Furthermore, surgical cyst removal is associated with high recurrence rates and is reserved for large, symptomatic cysts.[1,5,8] In adults, asymptomatic cysts discovered incidentally are likewise managed nonsurgically. Because popliteal cysts in adults are often associated with knee pathology, management of the underlying condition often leads to cyst regression.[1,2]

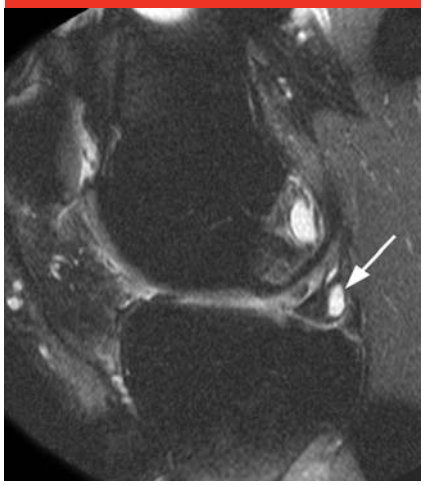
Cyst aspiration and steroid injections have been shown to be effective in some cases.[14] In a study of 15 patients with popliteal cysts, Grahame et al[15] partially aspirated the cysts and then administered an intra-articular injection of radioactive gold colloid. Eleven patients reported partial pain relief; 11 reported reduction in the size of the effusion; and the cyst disappeared completely in 4 patients. In general, cystectomy is discouraged except in cases of unremitting underlying joint pathology or the rare symptomatic primary cyst. However, cyst removal may be beneficial in patients with rheumatoid arthritis because the inflammatory nature of the synovial fluid can be quite bothersome. Jayson et al[16] reported on a series of nine rheumatoid knees treated with anterior synovectomy for symptomatic popliteal cysts. Following the procedure, three knees had improved symptoms and reduced cyst size, and six experienced complete resolution of the cyst.

Meniscal Cysts

Background

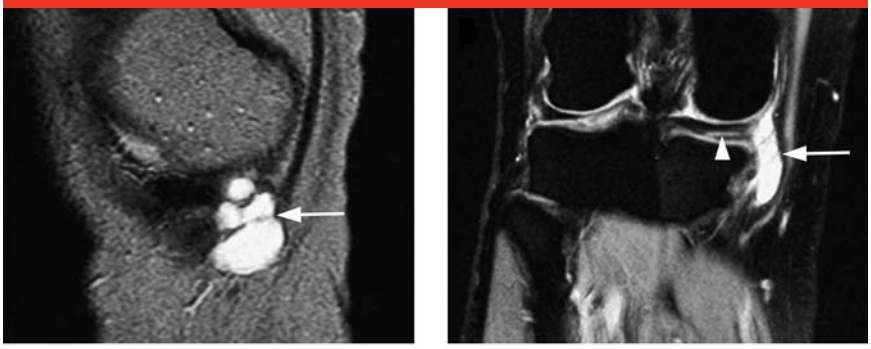
Meniscal cysts can be found in or about the medial and lateral menisci[4,8,17] (Figure 4). Typically, medial meniscal cysts originate posteriorly, projecting through the capsule and lying superficial to both the superficial and deep medial collateral ligament (MCL) but deep to the crural

Figure 4



Sagittal proton density–weighted magnetic resonance image with fat suppression demonstrating a small cyst within the posterior horn of the medial meniscus, consistent with an intrameniscal cyst (arrow). (Reproduced with permission from Marra MD, Crema MD, Chung M, et al: MRI features of cystic lesions around the knee. *Knee* 2008;15[6]:423-438.)

Figure 5



A B

Sagittal T2-weighted (4050/79) fast spin-echo (**A**) and coronal proton density–weighted (3000/25) fat-suppressed (**B**) magnetic resonance images demonstrating a horizontal tear (arrowhead) of the medial meniscus with an associated complex medial meniscal cyst (arrows). (Reproduced with permission from Beaman FD, Peterson JJ: MR imaging of cysts, ganglia, and bursae about the knee. *Rad Clin North Am* 2007;45[6]:969-982,vi.)

fascia.[8] Lateral meniscal cysts maintain a closer relationship to the joint capsule because the lateral meniscus is not attached to the lateral collateral ligament. Anterolateral and midlateral meniscal cysts usually pass through the capsule and lie deep to the iliotibial tract. Generally, posterolateral meniscal cysts are located deep to the lateral collateral ligament and tend to extend anteriorly. It has been suggested that tears of the lateral meniscus allow fluid to escape into the popliteus tendon sheath instead of into the adjacent soft tissue.[8]

Most meniscal cysts are believed to be the result of meniscal tears (Figure 5). The rate of cyst communication with a horizontal meniscal tear has been reported to be as high as 98%.[4,8,17] Some authors have postulated that cyst formation occurs via extravasation of joint fluid into/through the meniscal tear.[4,8,18] Others suggest that a congenital abnormality or traumatic event may allow translocation of synovial cells into the meniscus with subsequent production of synovial fluid manifesting as a meniscal cyst.[4,8,18] Additional theories of cyst formation include chronic infection, hemorrhage, and mesenchymal deposition of mucopolysaccharides.[19,20]

Several studies have attempted to determine the prevalence and typical locations of meniscal cysts. Campbell et al[18] reviewed 2,572 MRI studies of the knee and found that 109 knees (4%) had meniscal cysts. Two thirds (72) of these cysts were associated with the medial meniscus, most of which (74%) were adjacent to the posterior horn. One third (37) of the cysts were associated with the lateral meniscus, most of which (54%) were adjacent to the anterior horn. The relative distribution of meniscal cysts reflects the tendency of medial meniscal tears to affect the posterior horn and the more balanced distribution of lateral meniscal tears. Furthermore, medial and lateral meniscal tears had nearly identical associations with cyst formation: 7.8% and 7.7%, respectively. Tschirch et al[19] reviewed 102 magnetic resonance images of asymptomatic knees in patients with contralateral knee pathology and found meniscal cysts in 4 knees (4%). All of these cysts were associated with the medial meniscus; three were concurrent with meniscal tears and the fourth was associated with meniscal degeneration.

Clinical Presentation

Frequently, meniscal cysts are incidental findings on MRI. However, symptoms can include joint line pain, swelling, and a palpable mass.[8,17] In addition, there are reports of atypical presentations.

Lu[21] reported on a patient with anterior knee instability and intermittent knee pain who was found to have bony erosion of the proximal tibia on plain radiography. On MRI, a cyst that communicated with a lateral meniscal tear was identified lateral to the distal ACL. At least 14 cases of bony erosion associated with parameniscal cysts have been reported, but this case is the only reported pericruciate meniscal cyst to cause such erosion.

Jowett et al[22] reported on a patient with a palpable mass of the lateral knee; weakness in the ipsilateral tibialis anterior, extensor hallucis longus, peroneus longus, and peroneus brevis muscles; and decreased sensation along the course of the deep and superficial peroneal nerves. Imaging revealed a lateral meniscal cyst compressing the common peroneal nerve.

Differential Diagnosis

Normal anatomic variants such as normal capsular recesses and extensions of the joint capsule can resemble meniscal cysts. These variants can be differentiated from cysts by noting that they represent direct extensions of the joint capsule and lack communication with a meniscal tear.[8] Pes anserine and semimembranosus bursitis are important diagnoses to consider because meniscal cysts often form adjacent to these bursae. MCL bursitis can be misdiagnosed as a meniscal cyst; however, these clinical entities can be differentiated from each other on MRI, with MCL bursitis presenting as inflammation between the superficial and deep portions of the MCL, and a meniscal cyst located superficial to the entire ligament. Popliteal cysts can be differentiated from meniscal cysts based on their location superficial to the medial head of the gastrocnemius muscle.[3,8,17]

Pericruciate meniscal cysts and posterior cruciate ligament (PCL) ganglion cysts have a similar presentation. On MRI, meniscal cysts can be differentiated from PCL ganglion cysts by noting the presence of a concomitant meniscal tear, communication between the cyst and a meniscal tear, location centered posterior to the PCL, or envelopment of the PCL. Other important diagnoses to consider include iliotibial band friction syndrome, intra-articular pathologies, and neoplasms.[8,17,21]

Evaluation

Physical examination is more likely to reveal a palpable mass in the setting of lateral meniscal cysts than medial meniscal cysts, with reported rates as high as 80% to 100%.[8,17,20,23] A cyst often decreases in size with knee flexion because increased perimeniscal soft-tissue pressure causes the cyst to empty its contents back into the joint.[24]

Imaging of meniscal cysts can be accomplished effectively with ultrasound, which has a reported sensitivity as high as 97%, specificity as high as 94%, and positive and negative predictive values of 100% and 94%, respectively. Ultrasound is the preferred imaging modality given its noninvasive nature, ease of examination, low cost, and the ability to perform dynamic imaging with knee ROM.[24] However, MRI is the standard of care because it offers superior visualization of intra-articular and extra-articular structures, including communications between cysts and meniscal tears.[8,17,20] Campbell et al[18] demonstrated the efficacy of MRI for detection of meniscal cysts in a study in which only 15% of MRI-confirmed cases were associated with a palpable mass. Diagnostic arthroscopy has also been used to detect meniscal cysts, but its widespread use is limited by its invasiveness, limited ability to detect extra-articular lesions, and difficulty in delineating the posteromedial meniscus.

Management

Historically, meniscal cysts were managed with isolated cystectomy or complete meniscectomy.[20] Today, meniscal cysts are generally managed with arthroscopic partial meniscectomy combined with cyst decompression or open cystectomy (Figure 6). Several studies have demonstrated the benefit of this combined approach.

Reagan et al[23] reviewed 31 patients (32 knees) with lateral meniscal cysts and noted that, of 12 patients treated with partial meniscectomy without cyst decompression, 6 (50%) had excellent/good results. In 20 patients treated with partial meniscectomy and open cystectomy, 80% excellent/good results were achieved.[23] Hulet et al[25] reviewed a series of 105 lateral meniscal cysts treated with arthroscopic partial meniscectomy and cyst drainage (91) or open excision (14). They reported excellent or good results in 87% of cases, with 11 cyst recurrences requiring a second procedure.[25]

Other authors have suggested that advances in image-guided aspiration allow for more efficacious aspiration-only approaches in patients who wish to avoid surgery.[21,24,26] Macmahon et al[26] evaluated the benefit of an aspiration-only approach, reporting on 18 patients with meniscal cysts aspirated under ultrasound guidance. Initially, all patients experienced symptomatic relief and were satisfied with the procedure. At 10 months, 10 patients remained symptom-free, 2 had infrequent symptomatic periods, and 6 had symptom recurrence.

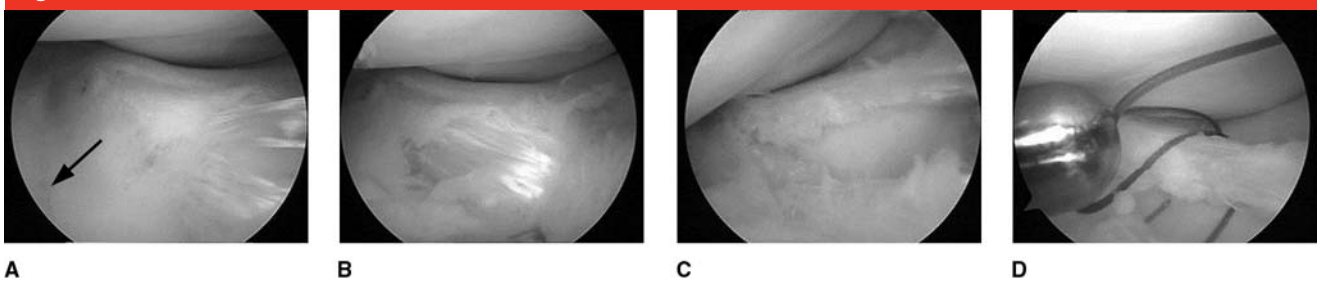
Proximal Tibiofibular Joint Cysts

Background

Cysts of the proximal tibiofibular joint (PTFJ) (Figure 7) are relatively rare, with reported prevalence ranging from 0.09% to 0.76% in patients undergoing MRI for knee pain.[27,28] The etiology of these cysts is unclear.

The PTFJ has been shown to communicate with the knee joint in roughly 10% of the population. In these persons, PTFJ cysts may occur secondary to increased intra-articular pressure in the knee.[4,8,29]

Figure 6



Intraoperative arthroscopic images of the knee demonstrating an extra-articular meniscal cyst (arrow) (**A**) arising from the anterior segment of the lateral meniscus. **B,** An old peripheral tear is visible at the anterior horn of the lateral meniscus. Arthroscopic freshening of the tear is performed (**C**) and then the meniscal tear is repaired (**D**), with no penetration of the meniscal fragment. (Reproduced with permission from Lu KH: Arthroscopic meniscal repair and needle aspiration for meniscal tear with meniscal cyst. *Arthroscopy* 2006;22[12]:1367.e1-e4.)

PTFJ cysts that do not communicate with the knee joint may lose their connections to the joint after formation, or the connection may degenerate into a fibrous cord. Another theory is that these cysts arise from the bursae present in the PTFJ capsule due to irritation or injury to soft tissues adjacent to the joint, or because of degeneration of a nerve schwannoma or neurinoma.[27,30,31]

PTFJ cysts typically range from 3 to 5 cm in diameter but have been reported to be as large as 20 cm along the dominant axis.[31] Although no formal classification system exists, some PTFJ cysts have been known to invade tissue (ganglion migrans) and are categorized by the tissue they invade (intramuscular, intraosseous, or intraneural).[30-32]

Clinical Presentation

PTFJ cysts usually present with pain and swelling on the lateral aspect of the leg, just distal to the knee joint. Exercise and prolonged standing can lead to an increase in cyst size, causing intense pain that often resolves with rest.[32,33] The cysts tend to increase in size over time, often leading to compression and/or invasion of the common peroneal nerve as well as adjacent muscles. This results in motor weakness of the anterior and/or lateral compartments with possible foot drop, pain, or sensory loss along the anterolateral leg and dorsum of the foot, and/or anterior or lateral compartment syndrome.[4,8,27,29,34] Sometimes PTFJ cysts are initially asymptomatic but become acutely symptomatic with cyst hemorrhage.[29]

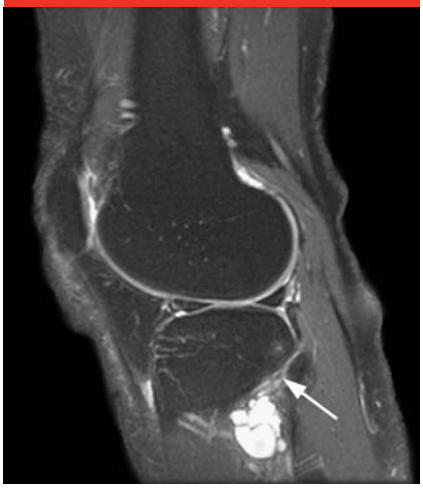
Differential Diagnosis

In patients with a suspected PTFJ cyst, differential diagnosis includes intra-articular degenerative pathology such as arthrosis and meniscal tears, especially in patients who complain only of vague joint "fullness" or lateral knee pain. Neoplasms must also be ruled out, including schwannoma and neurofibroma, which can lead to neurologic deficits similar to those associated with PTFJ cysts. Synovial sarcoma and juxta-articular myxoma are other important diagnoses to consider.[4,8,28,30]

Evaluation

MRI evaluation provides the most accurate delineation of a cystic mass and its communication with the proximal tibiofibular or knee joint, its relationship to adjacent structures (especially the common peroneal nerve), and associated intra-articular pathology. Increased muscle signal secondary to denervation is an important finding because it could be a sign of common peroneal nerve involvement.[8,27,29] Ultrasound is sometimes used to evaluate PTFJ cysts, but this modality is limited in its ability to discover connections to

Figure 7



Sagittal proton density–weighted magnetic resonance image with fat suppression demonstrating a lobulated cyst with a neck extending into the proximal tibiofibular joint (arrow), which is consistent with a proximal tibiofibular joint cyst. (Reproduced with permission from Marra MD, Crema MD, Chung M, et al: MRI features of cystic lesions around the knee. *Knee* 2008;15[6]: 423-438.)

joint spaces and accuracy in differentiating a cyst from a malignant growth.[27,29] In general, radiographs are unremarkable, showing generalized soft-tissue swelling and occasional bony erosion, but they can show intraosseous cysts.[29]

Management

In general, symptomatic PTFJ cysts are managed surgically with excision of the cyst and its connection to the joint.[8,27,29,31-33] This should be done promptly when the cyst involves the common peroneal nerve because the likelihood of motor and sensory recovery decreases over time.[31] Even with adequate surgical resection, the recurrence rate is high, ranging from 10% to 38%.[27,29,32] Recurrent PTFJ cysts can be re-excised; this allows identification and protection of the common peroneal nerve.[33] Some have found that PTFJ fusion may be more efficacious for management of recurrent PTFJ cysts.[30] Image-guided cyst aspiration with steroid injection has been used in cases that do not involve the common peroneal nerve, but this modality is associated with high rates of recurrence.[8,27,29]

Cruciate Ligament Ganglion Cysts

Background

In the knee, cruciate ligament ganglion (CLG) cysts involve the ACL and PCL (Figures 8 and 9). Several studies have reported a more common association with the ACL than with the PCL, but this is not widely accepted.[35-38] In general, these cysts reside within or adjacent to the cruciate ligaments but have been known to extend into other tissues, including bone.[35,36] Classification is based on the position of the cyst relative to the cruciate ligaments: anterior to the ACL, between the ACL and PCL, or posterior to the PCL. The estimated prevalence of CLG cysts ranges from 0.2% to 1.9%.[8,36] The cysts have a male predilection and can range in size from 0.5 to 4.5 cm.[36-38]

The etiology of CLG cysts is unknown. One theory is that they result from synovial herniation or congenital translocation of synovial cells into the cruciate ligaments; however, this is unlikely because ganglion cysts lack a synovial lining. Another theory is that mesenchymal stem cell proliferation or cellular hyperplasia in the cruciate ligaments leads to release of hyaluronic acid and cyst formation. However, the most commonly accepted theory is that mucoid degeneration of the cruciate ligaments in areas subjected to constant stress is responsible for cyst formation.[8,37] Although CLG cysts are associated with other intra-articular pathologies such as meniscal tears and chondral lesions, it is unclear whether these injuries have any role in cyst formation.[37,38]

Figure 8

Sagittal proton density–weighted magnetic resonance image with fat suppression demonstrating a typical anterior cruciate ligament (ACL) ganglion cyst (arrow), extending along the ACL and interspersed with the fibers. (Reproduced with permission from Marra MD, Crema MD, Chung M, et al: MRI features of cystic lesions around the knee. *Knee* 2008;15[6]: 423-438.)

Figure 9

Sagittal T2-weighted magnetic resonance image showing a multiloculated cyst (arrowheads) located adjacent to the dorsal surface of the posterior cruciate ligament (PCL), consistent with a PCL ganglion cyst. (Reproduced with permission from Marra MD, Crema MD, Chung M, et al: MRI features of cystic lesions around the knee. *Knee* 2008;15[6]: 423-438.)

Clinical Presentation

The most common presenting symptom in a patient with a CLG cyst is knee pain. Kim et al[36] reviewed 20 patients with ganglion cysts and noted that all patients reported knee pain but that the pain was reproducible on examination in only 12 patients (medial joint line pain in 4, lateral joint line pain in 3, infrapatellar pain in 3, and popliteal pain in 2). Patients may also note limited ROM and mechanical symptoms such as clicking and locking. The symptoms can be intermittent or constant and are often worse with exercise, especially squatting, which can squeeze the cyst between the cruciate ligaments and the roof of the intercondylar notch or the cruciate liga-

ments themselves.[35-37] Palpable masses are not typically present unless there has been extra-articular extension. CGL cysts can also be asymptomatic and maybe found incidentally on MRI.[35]

Differential Diagnosis

In one study, a recess behind the inferior border of the Hoffa fat pad was identified in 18 of 133 patients (13.5%) referred for MRI of the knee; this recess can fill with fluid and be mistaken for an intra-articular ganglion cyst.[8] Synovial cysts and meniscal cysts can be difficult to distinguish from CLG cysts. Other pathologies, including hemangioma, synovial sarcoma, and villonodular synovitis, can be misdiagnosed as cysts, but these pathologies present with unique MRI features that should facilitate proper diagnosis.[8]

Evaluation

CLG cysts are best visualized on MRI.[35-38] Ultrasound, CT, arthrography, and arthroscopy can also be used to diagnose these cysts, but these modalities are considered less practical and/or efficacious.[35,38]

Management

Arthroscopic excision of CLG cysts is the most common treatment option (Figure 10). Several authors have shown this to be an effective option with no symptomatic recurrences postoperatively.[35,37,38]

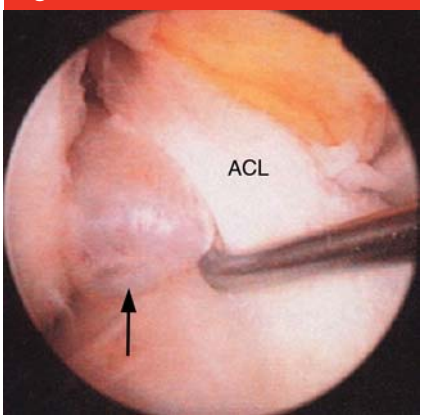
Image-guided percutaneous aspiration has been advocated as a cost-effective treatment that avoids the potential complications associated with surgical intervention; however, limited data exist regarding the use of this modality. DeFriend et al[39] reported on two patients with ganglion cysts treated with ultrasound-guided aspiration. Both were symptom-free and without recurrence at an average follow-up of 1.5 years. Antonacci et al[40] presented a series of three patients with CLG cysts treated with CT-guided aspiration. At 1-year follow-up, two patients were symptom-free without recurrence and one patient had a recurrence within 3 months. The procedure was noted to cause considerable pain in each case.

Differentiating Cysts From More Aggressive Lesions

Multiple pathologic entities can masquerade as cysts about the knee, including synovial processes, bone tumors, and soft-tissue tumors. Differentiating benign cysts from these lesions can pose a significant challenge. In a series of 667 patients with diagnosed knee tumors, Muscolo et al[41] reported that 25 had previously undergone an intra-articular procedure secondary to a misdiagnosis of athletic injury. Several clinical characteristics may be more indicative of a cystic lesion than of a malignant lesion, including a relatively slow rate of growth, fluctuating size, and the ability to transilluminate.[42] However, some malignant tumors, such as synovial sarcoma, can be present for long periods of time without appreciably enlarging. In general, any mass about the knee that is fixed, deep, and >5 cm in diameter requires a radiographic evaluation and should be presumed malignant until proven otherwise.

On plain radiographs, the presence of calcifications in a soft-tissue mass should raise suspicion of a more aggressive lesion. MRI with gadolinium contrast also can be used to differentiate cysts from soft-tissue lesions; a cyst often lacks central enhancement, whereas a solid mass will exhibit heterogeneous central enhancement.[43] A biopsy is necessary to confirm a suspected soft-tissue sarcoma and is typically performed by an orthopaedic oncologist or interventional radiologist. Oncologic principles must be followed during any biopsy procedure.

Figure 10



Arthroscopic image demonstrating a ganglion cyst (arrow) arising from the lateral aspect of the anterior cruciate ligament (ACL). (Reproduced with permission from Roeser WM, Tsai E: Ganglion cysts of the anterior cruciate ligament. *Arthroscopy* 1994;10[5]:574-575.)

Summary

Popliteal, meniscal, PTFJ, and CLG cysts are four common cystic masses found about the knee. It is difficult to distinguish these entities based on history and examination alone because all typically present with knee pain. MRI is the most effective imaging modality for accurate diagnosis of these lesions; it clearly defines anatomy, depicts the relationship of the cyst to local structures including the joint space, and can identify associated intra-articular pathologies.

Management is based on symptomatology and can range from nonsurgical measures to open excision. Differentiating cysts from more aggressive lesions is critical and can be done based on history, examination, and radiographic findings. Biopsy should be undertaken in the setting of suspicion of a malignant lesion.

References

Evidence-based Medicine: Levels of evidence are described in the table of contents. In this article, references 6 and 14 are level III studies. References 3, 5, 7, 9, 11-13, 15, 16, 18, 19, 23, 25-33, and 35-41 are level IV studies. References 1, 2, 4, 8, 10, 17, 20-22, 24, 34, 42, and 43 are level V expert opinion.

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